

# Molarity & Limiting Reactants.

GT KEY

1. Calc. Molarity.

$$a. 24.5 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.0 \text{ g NaOH}} = 0.6125 \text{ mol NaOH}$$

$$\frac{0.6125 \text{ mol NaOH}}{0.250 \text{ L Soln.}} = 2.45 \text{ M NaOH}$$

b.

2. Calc # grams solute.

$$a. 0.15 \text{ M AgNO}_3 = \frac{x \text{ mol AgNO}_3}{0.125 \text{ L Soln}} \rightarrow 0.01875 \text{ mol AgNO}_3 \times \frac{169.86 \text{ g AgNO}_3}{1 \text{ mol AgNO}_3} =$$

$$\begin{aligned} \text{Ag} &= 107.87 \\ \text{N} &= 14.01 \\ \text{O} &= 16.00 \end{aligned}$$

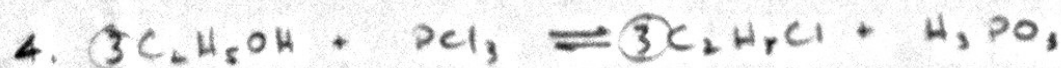
$$= 3.19 \text{ g AgNO}_3$$

b.

3. Calc volume if each in ml

$$a. 0.50 \text{ M NaCl} = \frac{0.12 \text{ mol NaCl}}{x \text{ L Soln.}} = 0.24 \text{ L Soln} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 240 \text{ mL Soln.}$$

b.



$112\text{ g C}_2\text{H}_5\text{OH} \times \frac{1\text{ mol C}_2\text{H}_5\text{OH}}{46.09\text{ g C}_2\text{H}_5\text{OH}} = 2.43\text{ mol C}_2\text{H}_5\text{OH} / 3 = 0.81\text{ mol}$

C = 12.01

H = 1.01

O = 16.00

P = 30.97

Cl = 35.45

$34.7\text{ g PCl}_3 \times \frac{1\text{ mol PCl}_3}{137.32\text{ g PCl}_3} = 0.253\text{ mol PCl}_3$

limiting reagent

$0.253\text{ mol PCl}_3 \times \frac{3\text{ mol C}_2\text{H}_5\text{Cl}}{1\text{ mol PCl}_3} = \frac{64.52\text{ g C}_2\text{H}_5\text{Cl}}{1\text{ mol C}_2\text{H}_5\text{Cl}} = 49.0\text{ g C}_2\text{H}_5\text{Cl theoretical}$

$\frac{23.7}{49.0} \times 100 = 48.2\%$   $\left| \frac{\text{Theor} - \text{Exp}}{\text{Theor}} \right| \times 100 = \left| \frac{49.0 - 23.7}{49.0} \right| \times 100 = 51.6\% \text{ error}$



$2.09\text{ g H}_2\text{O} \times \frac{1\text{ mol H}_2\text{O}}{18.02\text{ g H}_2\text{O}} = 0.11598\text{ mol H}_2\text{O} / 6 = 0.01933\text{ mol}$

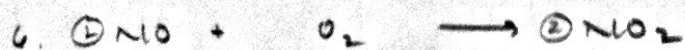
$11.0\text{ g N}_2 \times \frac{1\text{ mol N}_2}{28.02\text{ g N}_2} = 0.39258\text{ mol N}_2 / 2 = 0.19629\text{ mol N}_2$

$0.11598\text{ mol H}_2\text{O} \times \frac{4\text{ mol NH}_3}{6\text{ mol H}_2\text{O}} \times \frac{17.04\text{ g NH}_3}{1\text{ mol NH}_3} = 1.32\text{ g NH}_3$

$0.11598\text{ mol H}_2\text{O} \times \frac{2\text{ mol N}_2}{6\text{ mol H}_2\text{O}} \times \frac{28.02\text{ g N}_2}{1\text{ mol N}_2} = 1.08\text{ g N}_2 \text{ used}$

$11\text{ g N}_2 - 1.08\text{ g used} = 9.92\text{ g N}_2 \text{ left}$

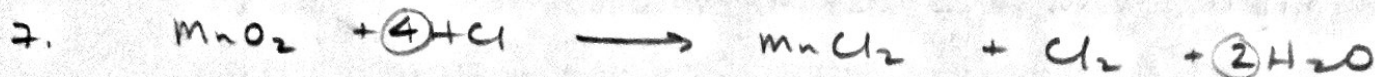




$$0.866 \text{ mol NO} / 2 = 0.433 \text{ mol NO R} \quad \text{Limiting.}$$

$$17.55 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} = 0.5484 \text{ mol O}_2 \text{ R} \quad \text{excess.}$$

$$0.866 \text{ mol NO} \times \frac{2 \text{ mol NO}_2}{2 \text{ mol NO}} \times \frac{46.01 \text{ g NO}_2}{1 \text{ mol NO}_2} = 39.84 \text{ g NO}_2$$



$$0.86 \text{ mol MnO}_2$$

$$\begin{aligned} \text{H} &= 1.01 \\ \text{Cl} &= 35.45 \end{aligned}$$

$$48.2 \text{ g HCl} \times \frac{1 \text{ mol HCl}}{36.46 \text{ g HCl}} = 1.32 \text{ mol HCl} / 4 = 0.330 \text{ R mol}$$

Limiting.

$$1.32 \text{ mol HCl} \times \frac{1 \text{ mol Cl}_2}{4 \text{ mol HCl}} \times \frac{70.9 \text{ g Cl}_2}{1 \text{ mol Cl}_2} = 23.4 \text{ g Cl}_2$$



$$637.2 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.04 \text{ g NH}_3} = 37.39 \text{ mol NH}_3 / 2 = 18.70 \text{ R mol} \quad \text{Limiting.}$$

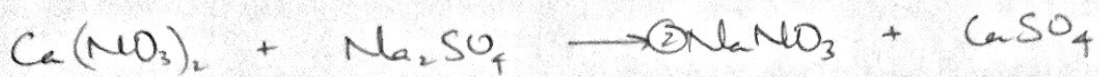
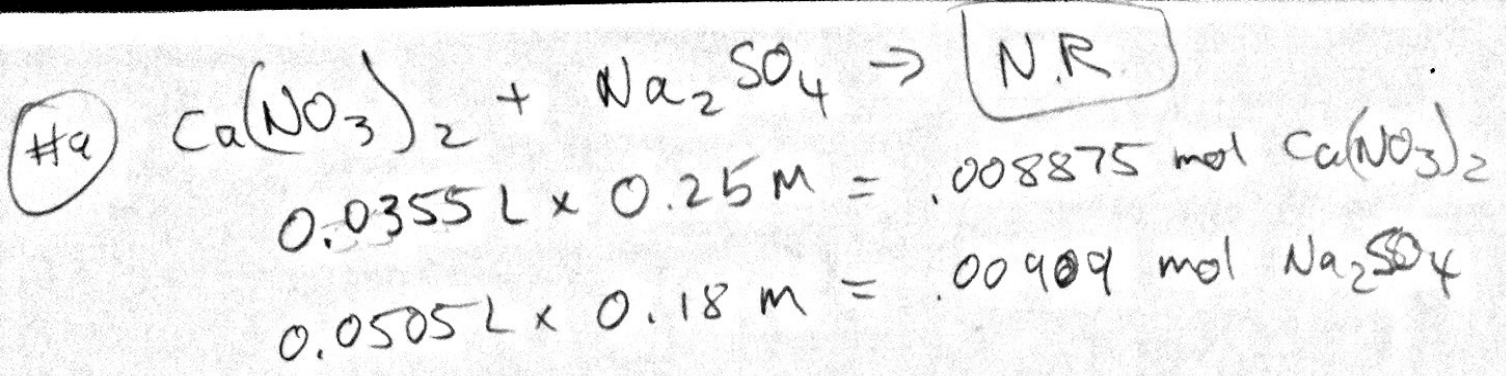
$$1142 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.01 \text{ g CO}_2} = 25.95 \text{ mol CO}_2$$

$$37.39 \text{ mol NH}_3 \times \frac{1 \text{ mol } (\text{NH}_2)_2\text{CO}}{2 \text{ mol NH}_3} \times \frac{60.07 \text{ g } (\text{NH}_2)_2\text{CO}}{1 \text{ mol } (\text{NH}_2)_2\text{CO}} = 1123 \text{ g } (\text{NH}_2)_2\text{CO}$$

$$37.39 \text{ mol NH}_3 \times \frac{1 \text{ mol CO}_2}{2 \text{ mol NH}_3} \times \frac{44.01 \text{ g CO}_2}{1 \text{ mol CO}_2} = 822.8 \text{ g CO}_2 \text{ used.}$$

$$1142 - 822.8 = 319.2 \text{ g CO}_2 \text{ left}$$

$$\% \text{ Yield} = \frac{1000}{1123} \times 100 = 89.1\% \text{ yield}$$



$0.25 \text{ M } \text{Ca}(\text{NO}_3)_2 = \frac{x \text{ mol}}{0.0355 \text{ L}} \rightarrow 0.008875 \text{ mol} \leftarrow \text{limiting}$

$0.18 \text{ M } \text{Na}_2\text{SO}_4 = \frac{x \text{ mol}}{0.0505 \text{ L}} \rightarrow 0.00909 \text{ mol}$

#10 a)  $0.008875 \text{ mol } \text{Ca}(\text{NO}_3)_2 \times \frac{1 \text{ mol } \text{CaSO}_4}{1 \text{ mol } \text{Ca}(\text{NO}_3)_2} \times \frac{136.15 \text{ g } \text{CaSO}_4}{1 \text{ mol } \text{CaSO}_4} = 1.20 \text{ g } \text{CaSO}_4$

$\text{Ca} - 40.08$

$\text{S} - 32.07$

$\text{O} - 16$

$= 136.15 \text{ g/mol}$

$\% \text{ yield } 82\% = 100\% \times \frac{x}{2.42 \text{ g } \text{CaSO}_4}$

$0.984 \text{ g}$   
 $= 1.98 \text{ g } \text{Exp Yield.}$